Spanish discards estimates of megrim (*Lepidorhombus whiffiagonis*) in Subarea VII and Divisions VIIIabd

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ABSTRACT

The Spanish discards estimates of the megrim (Lepidorhombus whiffiagonis) stock of ICES Subarea VII and Divisions VIIIabd (mgw-78) are derived from data compiled by the Spanish on-board sampling program, developed by the Spanish institutes IEO and AZTI following the European Data Collection Regulation (DCR, DCF) guidelines since its implementation in 2003. A description of the Spanish fishery and the respective discards sampling program, as well as an analysis of the sampling level and the estimation process of mgw-78 discards are presented.

Keywords: Fishing, Sampling, Discards, Megrim.

The Spanish fishery of the megrim stock mgw-78

The western stock of megrim (mgw-78) extends from the Celtic Sea (Subarea VII) to Bay of Biscay (Divisions VIIIabd), being more abundant in the first area (17385 t of TAC in VII and 1716 t in VIIIabd, in 2015). The Spanish quota covers 30% of TAC in VII, sharing the resource with other four countries (France, Ireland, United Kingdom and Belgium), and 55% in Divisions VIIIabd, where only Spain and France exploit this stock.

The Spanish fishery operating in Subarea VII and Divisions VIIIabd is compounded of trawlers, gill netters and longliners; however the bottom otter fleet targeting demersal fish present the highest amount of megrim catches (Table 1). This Spanish OTB fleet is currently split into three DCF métiers (Castro *et al.*, 2012), which can be ordered as follows in decreasing megrim landings:

- OTB_DEF_70-99_0_0: Bottom otter trawl targeting megrim and anglerfish in Subarea VII using a minimum mesh size of 80 mm.
- OTB_DEF_>=70_0_0: Bottom otter trawl targeting anglerfish, megrim and other demersal fish in Divisions VIIIabd with a minimum mesh size of 100 mm, although this can be reduced to 70 mm in conjunction with a 100 mm square mesh window (CEC, 2006).
- OTB_DEF_100-119_0_0: Bottom otter trawl targeting hake in Subarea VII using a minimum mesh size of 100 mm.

It is needed to say that the effort of the Spanish fleet has suffered a reduction through these last four years in non-Iberian European Atlantic waters: around 80% in métiers OTB_DEF_100-119_0_0, and closed to 25% in métiers OTB_DEF_70-99_0_0 and OTB_DEF_>=70_0_0.

The Spanish Discards Sampling Program (DSP)

The ICES Spanish Discards Sampling Program of the Spanish fleets operating in European Atlantic waters covers both Atlantic National fishing grounds (Cantabrian-Northwestern and Gulf of Cadiz), as well as the non-Iberian European waters where a number the Spanish vessels are allowed to fish, which exploit the western stock of megrim (mgw-78) among other species. From the first observed on-board information (Pérez et al., 1996), it was showed that the megrim discards arise basically from bottom otter trawlers and consist mainly of small fish, which are thought to be discarded as a direct result of the minimum landings size (MLS) and some so-called high-grading. Therefore, the sampling onboard the Spanish vessels operating in non-Iberian European Atlantic waters has been focused on bottom otter trawlers. The implementation of the Spanish DSP is shared between two Spanish laboratories: IEO covers bottom otter trawlers operating in Celtic Sea (ICES Subarea VII), and AZTI covers bottom otter trawlers operating in Bay of Biscay (Divisions VIIIabd).

The IEO's DSP was started in 1988; however its discontinuous implementation at the beginning, due to intermittent funding, only could be stabilized since the DCR (Data Collection Regulation) implementation in 2003 (table 2). From this information, the métiers sampled can be better described:

- OTB_DEF_70-99_0_0: this metier operates in waters from the continental shelf around the 200 m isobaths, makes short hauls, with trawls around 4 hours and comprising about 65 fishing hauls per trip.
- OTB_DEF_100-119_0_0: this metier is more restricted to deeper waters around the slope, makes about 5.5 hour hauls, resulting in about 30 fishing hauls per trip.

The IEO's DSP is based on a stratified random sampling, considering the DCF métier as stratum and the trip as sampling unit (Bellido and Pérez, 2007). Table 3 shows the number of trips, hauls and vessels sampled in the time period 2003-2014. The average of annual trips sampled is 9 for metier OTB_DEF_70-99_0_0 and 3 for metier OTB_DEF_100-119_0_0, giving a coverage level (n sampled trips/N total trips) of 2.2% and 2.7%, respectively.

The AZTI`s DSP started with two European projects in 1997 and 1999. When they were finished, it was maintained at a low level until the DCR (Data Collection Regulation) was implemented in 2003. In relation to megrim, the main metier sampled can be described as follows:

- OTB_DEF_>=70_0_0: This metier operates in waters from the continental shelf between the 100 and 150 meters isobaths. The duration of the hauls are between 3 and 4 hours with a trawling speed of 3-3.5 Knots. The duration of the trips are 5 days comprising about 25-30 fishing hauls per trip

The AZTI's DSP is based on a stratified random sampling, considering the combination of gear, area and quarter as stratum and the trip as sampling unit. Table 3 shows the number of trips, hauls and vessels sampled in the time period 2003-2014.

Survey design

The IEO's DSP tries to follow a random selection of vessels; however, it can be totally implemented only in métier OTB_DEF_70-99_0_0 thanks to the cooperation of this fleet's stakeholders. The difficulties of accessibility to vessels developing the métier OTB_DEF_100-119_0_0 has forced to apply a quasi-random vessel selection process.

AZTI's DSP has always been designed to get a representative sample of the activity of the fleet and to minimize biases related to the selection of the vessels. However, the decreasing number of vessels and the difficulties to board on some of them, difficult the implementation of a true random selection of vessels. In 2014 some modifications in the sampling design were introduced in order to move towards a more probability based sampling design: (1) the selection of vessels is performed randomly with a list of vessels and weeks at the beginning of the year, (2) some rules are established to select a second vessel in the case of refusal or lack of activity, (3) refusals are recorded.

For both DSP's, the sampling strategy and the estimation methodology are in accordance with the "*Workshop on Discard Sampling Methodology and Raising Procedures*" (ICES, 2003), "*Working Group on Discard Raising Procedures*" (ICES, 2007) and "*Study Group on Practical Implementation on Discard Sampling Plans*" (ICES, 2012) guidelines.

Information collected on board consists of descriptive information on the vessel and hauls made during each trip, alongside with effort (e.g., trawl duration) and detailed information on catch, retained and discarded per species, namely weight and length composition. In each sampled trip, a determined number of hauls are, in turn, sampled as follows: a random sample of discarded species is selected. Megrim in the discards sample is measured for length and the weight is calculated using a length/weight relationship (Pereda and Pérez, 1995, in the IEO; and data based on sampling in AZTI). The resulting megrim weight in the discards sample is raised to haul level according to the total discarded weight of the haul and the proportion of megrim in the sample. Haul-raised data are further raised to trip level taking into account the total number of hauls in the trip.

Estimation and quality control procedures

Discards in weight and length by sampled trip are raised to the total activity of the métier. This was done raising to the métier total landings until 2011, when an improvement in the availability of official statistics made more feasible to use the total effort of the métier (total number of trips) in the raising procedure. Comparison of the results obtained by both raising procedures with 2012 data showed very high similarities (Figure 1), confirming the robustness of the data.

Until 2009, discards estimates were provided annually, as it was asked by DCR (Data Collection Regulation). However, since the DCF implementation, the raising procedure is done disaggregated by quarter, and also provided to InterCatch by ICES Division. However, the total discard weight of the métier, as well as the respective length frequency distribution, is allocated to the respective effort level developed in each Division.

The coefficient of variation (CV) is used as standardized measure of dispersion of a frequency distribution and represents the ratio of the standard deviation to the mean. The time series of discard weight CV values are show in Table 4 by métier, giving an average of 27.9 % and 45.3% for métiers OTB_DEF_70-99_0_0 and OTB_DEF_100-119_0_0, respectively. Discard weight (kg) variability per trip are represented for each métier in Figure 2, ordered by year.

However, the megrim discards are very low in métier OTB_DEF_>=70_0_0, the estimates obtained from the sampling have been analyzed and are considered not reliable. This is the reason why discards data for this métier have not been provided to WG and CV estimations were not available.

Potential biases affecting the data

The low sampling level of métier OTB_DEF_100-119_0_0 is considered an inconvenience of the IEO's DSP; however, the effect of this on the megrim discards estimation is thought to be not important because the low catches of megrim of this métier, which is directed to catch hake on the Grand Sole slope. Besides, this fleet has suffered a remarkable reduction in capacity and effort in last year's.

The generalized low sampling level of the European discards sampling programs usually produces large biases. For OTB_DEF_70-99_0_0, in which almost all hauls catch megrim and more than 92% discard megrim, the bias is relatively low (Figure 3).

The effect of OTB_DEF>=70 on the megrim discards estimation is thought to be unimportant and with low impact for the stock assessment

Provision and use of discards estimates

The available megrim discard estimates indicate that discards of younger ages are substantial, mainly in métier OTB_DEF_70-99_0_0; therefore, IEO has made an effort to provide feasible estimates of megrim discards in order to be used in the assessment. The mgw-78 stock is annually assessed by the "*WG for the Bay of Biscay and the Iberian waters Ecoregion*" (WGBIE), applying a catch-at-age model on a time series of landings starting in 1984, on which the Spanish discard data are incorporated since 1986 (ICES, 2015).

The 2015 joined ICES Data call asked for detailed descriptions of the National Discards Sampling Programs and the respective estimation procedures. Annex 1 reproduces one of the tables provided by IEO.

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Table 1. Spanish landings of western stock of megrim (mgw-78) for the period 2011-2014. Source: InterCatch (ICES). Metiers with negligible landings were reported to InterCatch aggregated under metier MIS_MIS_0_0_0.

		Landings (t)			
Area	Métier	2011	2012	2013	2014
Subarea VII	OTB_DEF_70-99_0_0	2789	3496	4360	2756
	OTB_DEF_100-119_0_0	358	139	84	16
	GNS_DEF_120-219_0_0	3	1	0	0
	LLS_DEF_0_0_0				
DivisionsVIIIabd	OTB_DEF_>=70_0_0	352	420	538	546
	GNS_DEF_>=100_0_0	92	64	21	30
	OTB_MCF_>=70_0_0				
	OTB_MPD_>=70_0_0				
	OTB_SPF_>=70_0_0				
	PTB_DEF_>=70_0_0				
	LLS_DEF_0_0_0				
Spanish Total landings of mgw-78		3594	4120	5003	3348

Table 2. Spanish Discards Sampling Programmes.

Year	IEO's Projects	AZTI's Projects
1988-1989	National project	-
1994	EC Project: Pem/93/005	-
1997	EC Project: 95/ 094	EC Project: 95/ 094
1999-2000	EC Project: 98/095	EC Project: 98/095
1999-2015	-	Basque Gov. project
2001	EC Project: 99/063	-
2003-2014	DCF Programme	DCF Programme
2009-2012	-	Interreg project PRESPO

Table 3. Discards Sampling Level.

	OTB_DEF_70-99_0_0			OTB_DEF_100-119_0_0			OTB_DEF_>=70_0_0		
	Trips	Hauls	Ships	Trips	Hauls	Ships	Trips	Hauls	Ships
2003	7	315	7	2	54	2	6	74	4
2004	8	338	8	3	61	3	4	58	3
2005	7	276	7	3	60	3	11	198	7
2006	9	301	9	4	75	4	10	158	5
2007	9	299	9	3	69	3	12	219	5
2008	7	246	7	4	107	4	14	236	7
2009	9	285	9	6	143	6	10	162	8
2010	9	297	9	4	85	4	5	100	3
2011	9	253	9	2	40	2	7	150	5
2012	9	314	9	2	26	2	3	66	2
2013	10	316	10	NS	NS	NS	12	240	5
2014	12	299	10	1	13	1	13	251	6

Table 4. Discards sampling CV per métier (*No sampled; **1 trip) for metiers OTB_DEF_70-99_0_0 and OTB_DEF_100-119_0_0.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
OTB_DEF_70-99_0_0	0.24	0.36	0.28	0.40	0.19	0.25	0.30	0.33	0.19	0.10	0.35	0.36
OTB_DEF_100-119_0_0	0.78	0.48	0.04	0.18	0.54	0.86	0.40	0.1	0.12	1.03	*	**
OTB_DEF_>=70_0_0	na	na	na	na	na	na	na	na	na	na	na	na

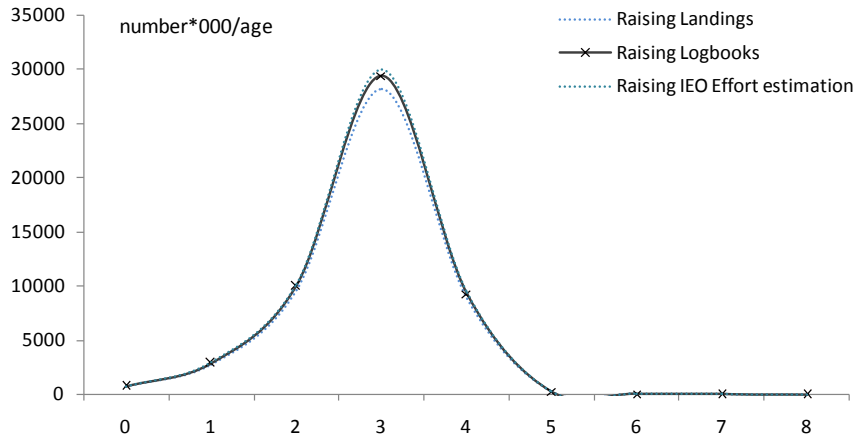

Figure 1. Comparison between different discard raising procedures by age (2012 data): raising to total métier landings, and to total métier effort (calculated from logbooks and own IEO sources).

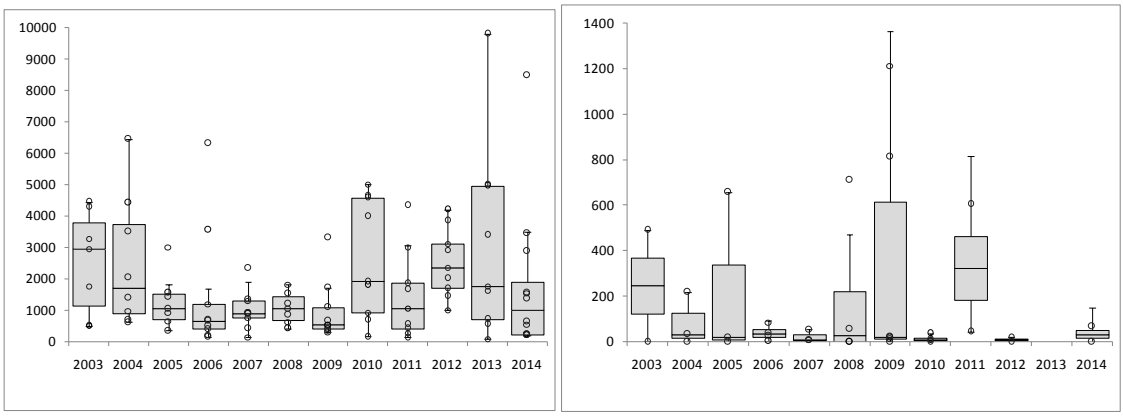

Figure 2. Box plot of median and distribution of discards weight (t) per trip and métier: OTB_DEF_70-99_0_0 (left) and OTB_DEF_100-119_0_0 (right).

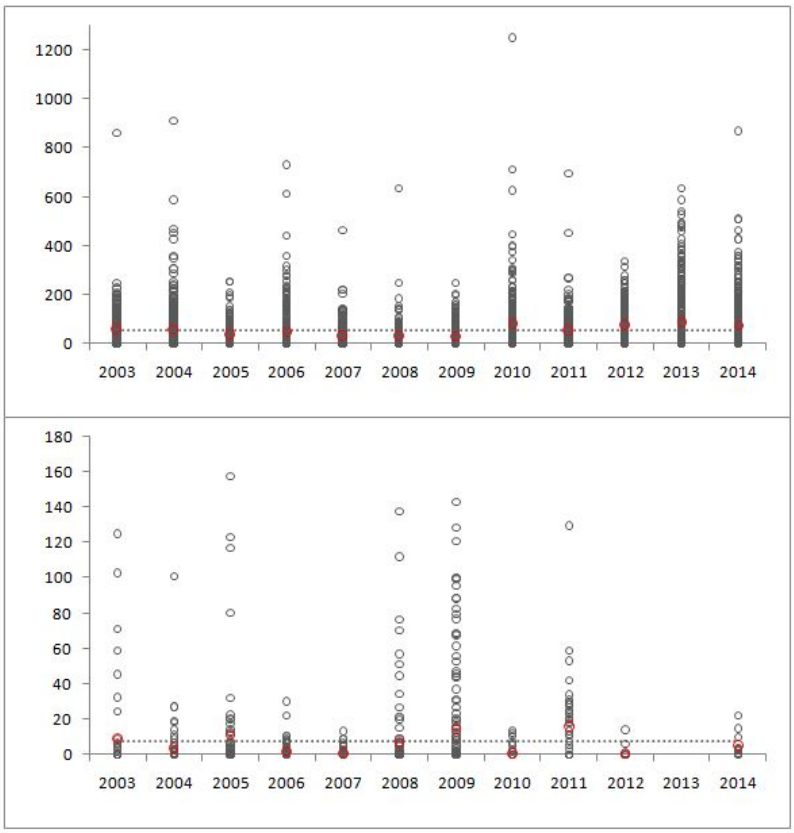

Figure 3. Catch by hauling tons (open circles), yearly means (red circles) and average of annual means (line) per métier: OTB_DEF_70-99_0_0 (top) and OTB_DEF_100-119_0_0 (bottom).

Annex 1

ICES 2015 Assessment Expert Groups summary of national discards sampling programme design

Country: Spain **ICES Assessment Expert Group: WGBIE**

Sampling programme name: Spanish Discard Sampling Programme

Stocks covered by programme: anb-78ab, anb-8c9a, anp-78ab, anp-8c9a, Bss-8c9a, gug-89a, hke-nrtn, hke-soth, mgb-8c9a, mgw-78, mgw-8c9a, nep-25, nep-2627, nep-30, nep-31, ple-89a, pol-89a, sol-8c9a, whg-89a

	Sampling frame		Survey design and sample selection		Estimation procedures			Self evaluation of potential for bias (1-3 where 1 is the best)
Years/ time periods	Vessel sizes and gears covered	ICES Divisions covered	Describe Survey design and vessel selection	Stratification	Raising procedure for stratum estimates for a stock	Methods to impute missing stratum estimates "borrowing procedures"	Variance estimates	
2012	Vessels >12m using towed demersal trawls and gill nets	VIIb-k, VIIIc and IXa	Stratified random,quasi-random and cooperative vessel in samplingvessel selection (depend on métier)	Stratified by métier and quarter	Trip-raised estimates by stratum (métier and quarter)	Métier estimates for sampled strata are combined and raised to all reported effort including missing strata.	Analytical	2
2013	As above	As above	As above	As above	As above	As above	As above	2
2014	As above	As above	As above	As above	As above	As above	As above	2
Name of person completing table:			Nélida Pérez			Date:	6/10/2015	